DOCUMENT RESUME

ED 452 044 SE 064 575

AUTHOR	Gomez, Luis Alberto; Lemos, David; Carlos de Souza, Antonio; Speck, Henderson Jose
TITLE	Virtual Reality in the Teaching of the Technical Drawing.
PUB DATE	2000-08-00
NOTE	6p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Computer Graphics; *Design; Higher Education; *Internet; Models; Secondary Education; *Technical Education; *Virtual Reality

ABSTRACT

This paper proposes the use of the Virtual Reality Modeling Language (VRML) language for teaching technical drawing projections. Three dimensional models and exercises are left to students over the Internet substituting the old wood models in the classroom. An introduction to the VRML language is presented. A detailed description on how models are created and an exercise is shown. (Author/SAH)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 452 044

Virtual Reality in the Teaching of the Technical Drawing

Luis Alberto Gómez - MEE-USFC–ECV–Cx. 476 - CEP88040-900 Fpolis-SC - Brasil
David Lemos - M.Eng-USFC–EGR–Cx. 476 - CEP88040-900 Fpolis-SC - Brasil
Antônio Carlos de Souza - Eng-USFC–EGR–Cx. 476 - CEP88040-900 Fpolis-SC - Brasil
Henderson José Speck-Eng - USFC–EGR–Cx. 476 - CEP88040-900 Fpolis-SC - Brasil

ABSTRACT: *This paper proposes the use of the VRML language for teaching Technical Drawing projections. 3-D Models and exercises are left to students over the Internet substituting the old wood models in the classroom. An introduction to the VRML language is presented. A detailed description on how models are created and an exercise is shown.*

1. Introduction

The Technical Drawing teaching in Architecture and Engineering usually trains the students to show three-dimensional elements in a bi-dimensional representation given by views and perspectives. Because this kind of abstraction represents one of the great difficulties for the students a large number of exercises are given to them, always based in full or small scale wood made models.

The tools for drawing and design have change dramatically over the last decade, by the introduction of the Computer Aided Design (CAD) programs. The teaching is also changing by the use of Internet. The changes on the teaching of Technical Drawing can not be limited just to teach how to use a CAD program. It has to break the gap between the real elements and the way we represent them.

The use of the VRML and Internet gives the students the possibility of "handling" a model in a virtual way. In an indirect way the students are motivated to make the exercises that are proposed. This technique also allows supervised distant learning, reaching different areas of the teaching of Technical Drawing, specially the representation of orthogonal projections, exploded views and perspectives of parts and models.

Another important application of the method proposed is the teaching of architecture and engineering in the cooperative design of machines, tools or buildings by students with different backgrounds, skills and probably in different physical locations, interchanging draft drawings and data over the Internet.

This methodology approaches the students with the challenges that will find in the industrial technology-based economy of the 21st century, and gives them the basis skills for cooperative engineering, distance learning and problem solving.

2. The VRML language

Tim Berners-Lee and Dave Raggett, from CERN, the creators of the WWW ("World Wide Web") proposed the VRML language in 1994. From this idea a draft standard was established [1] defining the basic characteristics of the language.

The VRML language (VRML is an acronyms for "Virtual Reality Modeling Language") is a scene description language that works with three-dimensional models over the Internet. Accessing an URL (Unique Resource Locator) containing a VRML document (this documents are call "worlds"), the information is downloaded into the Internet browser. As the browser detects the type of file, a VRML visualizer is initiated. This visualizer allows to move the scene (and/or the observers) in a three dimensional virtual world. The files containing the "VRML Worlds" have a ".wrl" suffix, in opposition to the ".html" suffix in traditional WWW pages..

The VRML language allows adding other information into the three-dimensional model, such as links to other Internet documents. As its ancestor, the HTML language, the VRML language, works in a large variety of platforms, from personal computers to powerful workstations. Another important feature of VRML: it is compact, allowing a reasonable response time over the Internet. Complex three-dimensional models can be described in files with size compatible with the size of common HTML documents.

Now a day, browsers allow visualizing the VRML models either directly or through the use of "plug-ins".

The VRML language has evolved and the version accepted as standard by the industry (Silicon Graphics,

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
L Gomez
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

Sony, Microsoft, AutoDesk, etc.) is the VRML 2.0 which has a code name of "Moving Worlds" [2].

Straight construction of models by using the VRML language is simple but time consuming. A large number of tools were developed to create "worlds" by using simple commands and geometrical primitives. One of the tools of this kind is the "Cyber Passage Conductor" developed by Sony [3]. The large amount of time consumed with these tools is still a problem. In the last year, many converter programs appear in the market or were incorporated to existing programs, allowing to pass form three-dimensional drawing stored in the ".dxf" (Drawing Interchange Format) or ".max" (3D-Studio MAX) formats directly to VRML 2.0 models. Other sources of information on the VRML language are mentioned in reference [4], [5] e [6].

3. Using VRML in the Teaching of Technical Drawing

The possibility of manipulating virtual three-dimensional objects offered by the VRML language, allows its direct use in the technical drawing teaching in all the Engineering areas and architecture. VRML models substitute with large advantages the traditional wood pieces and scale models in the teaching of views, projections and sections, where the students have large difficulties.

3.1. Objectives

By the use of three-dimensional VRML models, the following objectives are, seek:

- Up date the technical drawing teaching;
- Rise the degree of abstraction needed in the graphical representation;
- Prepare the future professionals to use new technologies, especially those that, like the shown here, allows an important gain in the productivity of industry;
- Incentive the individual and cooperative work of the students. In some cases students can do the work from different locations.

3.2. Methodology

The steps used for creating the three-dimensional models in VRML2.0 are:

3.2.1. Solid Modeling:

The models are created in a natural (1:1) scale using commercial CAD and solid modeling programs, as shown in Fig. 1

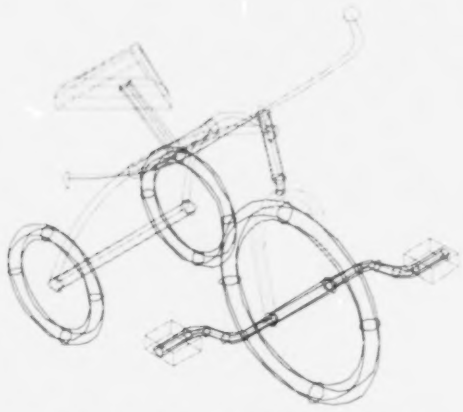

Fig 1. 3D solid model crated by a CAD program

3.2.2. Lights, cameras, textures and materials:

The solid model created in the previous step, gains materials, textures and is mounted in a scene with cameras and lights as shown in fig 2.

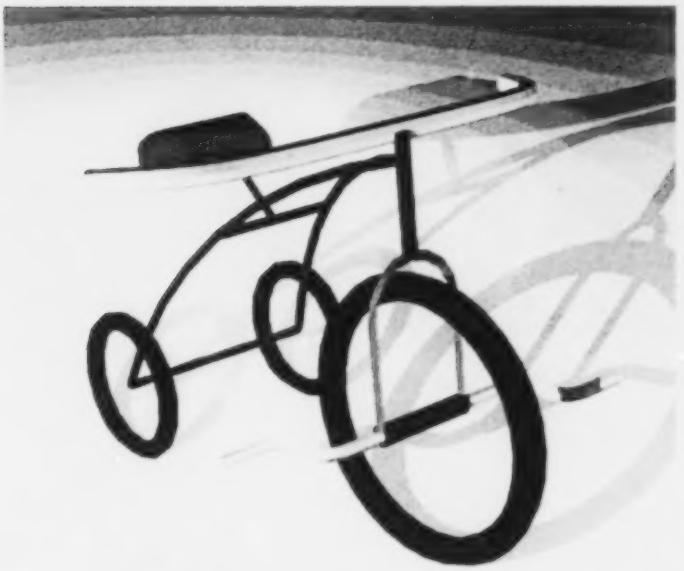

Fig 2. 3D solid model 3D with materials and textures in a scene with cameras and lights

3.2.3. Transforming a model 3D to VRML 2.0

The three-dimensional models with materials and textures, mounted in scenes defined by cameras and lights, are exported by using translators programs to virtual reality models. The solid model already load in the Internet browser (in this particular case the browser is the Nestcape using the "plug-in" COSMOS from Silicon Graphics) is shown in fig. 3. The icons, in the lower part of the screen, allow moving, rotating, dragging and zooming the virtual model.

3.2.4. Putting the models in a VRML 2.0 Server

The WWW Internet server (httpd) has to be configured to deliver also the virtual models.

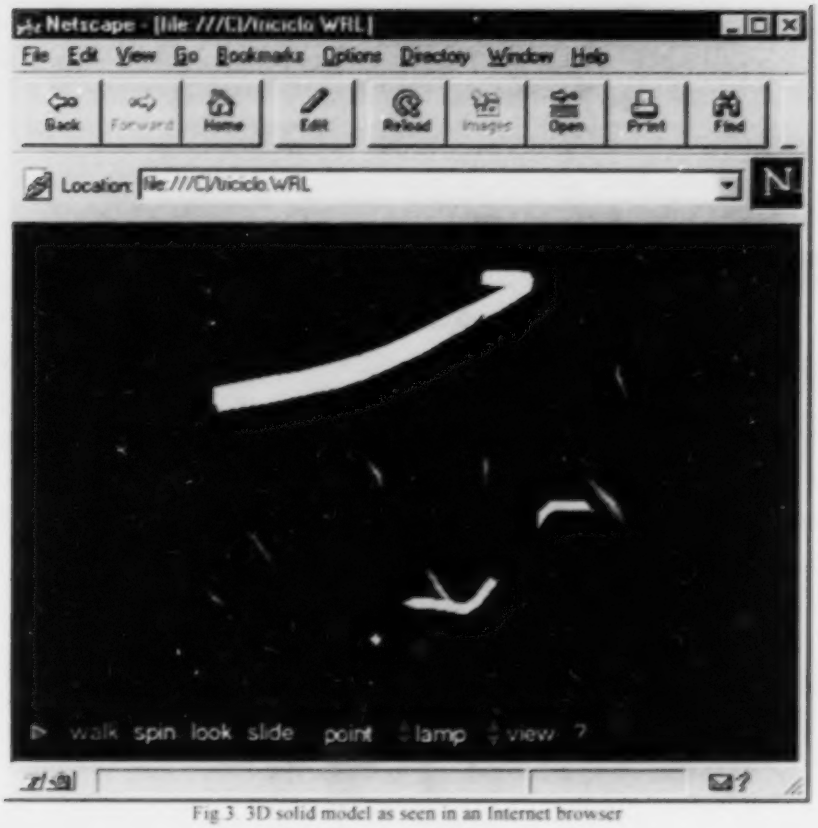
Netscape - [file:///C|/triciclo.WRL]
File Edit View Go Bookmarks Options Directory Window Help
Back Forward Home Edit Reload Images Open Print Find
Location: file:///C|/triciclo.WRL
walk spin look slide point lamp view ?

Fig 3 3D solid model as seen in an Internet browser

3.2.4. Drills:

Together with the models ".wrl", exercises and drills are left in the server. The exercises are of the following type: given the 3D model create or complete the orthographic projections. The exercises and drill are built in the form of "html" pages as shown in figures 4 and 5.

BEST COPY AVAILABLE

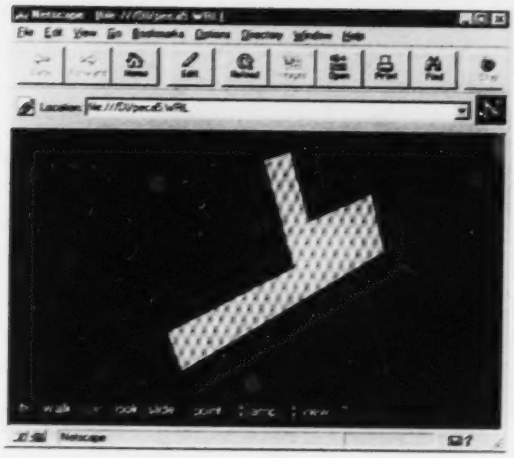

Fig.4. Solid model for the drill

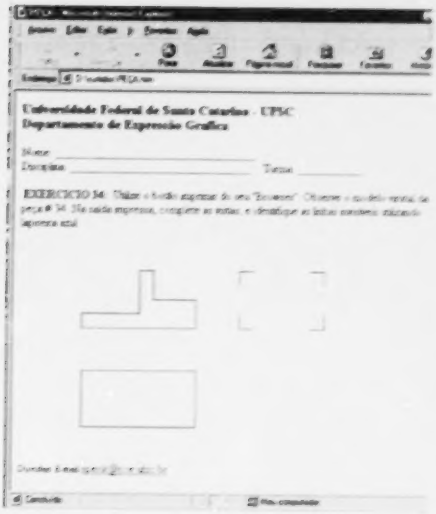

Fig.5. Drill based on the model of figure 4.

4. Conclusions

With the reduction of the computer prices and the setup of computer laboratories in most of the universities, the proposed technique represents an advance, not only in the teaching of technical drawings, as well as in the use of new productivity tools.

Tests where applied in two groups of 1st and 2nd semester engineering students. One group received wooden models and the other the same pieces but in VRML models. The students were asked to receive three common drills.

Result of the tests, showed in Table 1, indicate that the rate of success with this method is at least as good as the success given by conventional wood models.

Table1: Number of Mistakes per group

Drill/Group	Wood Models	VRML Models
Complete Orthographic Views	24	25
Draw hidden lines	11	7
Draw Perspective	12	8

Another aspects to be highlighted are the fact that, the students seem to be no intimidated by the use of this technique, and the learning on the use of the VRML browser is very fast.

References:

[1] "The Virtual Reality Modeling Language: Version 1.0 Specification", Article in the Internet: http://www.hyperreal.com/~mpesce/vrml/vrml.tech/vrml10-3.html.

[2] "The VRML 2.0 Specification", Article in the Internet: http://vrml.sgi.com/moving-worlds/VRML2.DRAFT3.html.

[3] "Learning Cyber Passage Conductor", Article in the Internet: http://vs.sony.co.jp/VS-E/works/editor/manual_web/tutotrial.html.

[4] "The VRML 2.0 Repository", Internet site: http://www.sdsc.edu/SDSC/Partners/vrml/doc.html.

[5] "VRML.SIG.COM", Internet site: http://vrml.sgi.com/intro.html.

[6] "VRML - Microsoft", Internet site: http:// http://www.microsoft.com/vrml/.

BEST COPY AVAILABLE